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INK JET PRINTABLE SECURITY DOCUMENT

BACKGROUND OF THE INVENTION

The present invention is directed generally to a security document, and in particular to a security document that can accept indicia printed thereon from a suitable printing process such that the printed indicia is sensitive to multiple modes of tampering, including attacks based on the application of heat, abrasion or solvents.

The use of security enhancements integrated into documents is well known. Examples include currency, checks and related negotiable instruments, as well as personnel identification devices, such as birth certificates, social security cards and driver's licenses, the latter of which are frequent targets of tampering because of their pervasive use as prima facie evidence of age, residency or the like. The ascendancy of high-speed non-impact printing devices to print large quantities of such documents has been in part due to their relative low cost and quiet, reliable operation. Ink jet printers are one form of non-impact printing, where highly atomized ink is sprayed onto a document surface. Printed indicia placed on the surface of a document from an ink jet printer forms a relatively clear, durable bond with the underlying document substrate. It would be additionally advantageous to maintain the conveniences of non-impact printing while simultaneously providing enhanced added security features. As such, there is a need for providing added security features through discrete coatings placed on documents formed by ink jet and related non-impact printing methods.

SUMMARY OF THE INVENTION

These needs are met by the present invention, which is directed to an anti-counterfeit, tamper-resistant security document. According to one aspect of the present invention, a security document includes a substrate, a first security coating disposed on the substrate, and a second security coating disposed on the first security coating. One of the security coatings is a solvent-sensitive coating and the other of the security coatings is an abrasion-sensitive coating. By this construction, attempts at tampering with the document produce notorious indicia of such

tampering on the document. In one form the notorious indicia of tampering comprises a predetermined pattern, such as warning phrase spelling out words such as "void" or the like. The substrate may be made up of a tear-resistant laminate where, for example, a layer of film is coupled to a layer of paper, or a layer of film is sandwiched between a pair of paper layers, in either case such that the film gives the laminate its toughness, while the paper makes it easy for the document to accept printed indicia from an automated printing device. While the present invention is preferably configured for use with ink jet printers, it will be appreciated by those skilled in the art that use with other non-impact printers, such as thermal transfer printers, is also contemplated, and therefore deemed to be within the scope of the present invention.

Optionally, a third security coating can be disposed adjacent one of the first or second security coatings. This third security coating can provide supplemental solvent protection to the document. For example, the third security coating could generally be a tinted water-based flexographic ink, and more particularly a flexographic ink made up of approximately ten to forty percent liquid dye, ten to ninety percent water-soluble binder, and up to one percent surface additive. In the present context, the use of the term "approximately" is meant to modify both the upper and lower ranges of each of the respective ingredients, not just the immediately following range. The third security coating can be configured to be sensitive to at least a solution containing phosphoric acid. This could be especially valuable in situations where the other solvent-sensitive coating is not tailored to respond to such a solution. In one form, the first security coating is a solvent-sensitive coating. This coating can also be configured to activate (or respond) to the application of an elevated temperature to the document. In another option, an authentication zone can be placed on the document to allow easy verification of the document's authenticity. In one form, the authentication zone can include a thermochromic ink disposed either in or adjacent to one of the document's security coatings or the substrate. In one particular configuration, the thermochromic ink comprises an uppermost layer of the document.

The document itself may include a folding region to allow the document to assume a substantially coextensive two-layer configuration when the document is folded along the folding region. As used in conjunction with the present disclosure, the term "substantially" refers to an

arrangement of elements or features that, while in theory would be expected to exhibit exact correspondence or behavior, may, in practice embody something slightly less than exact. Thus, the two layers (or flaps) of the folded-over document are intended to be coextensive, but due to margins within a given folding process, may not be perfectly so. To facilitate accurate folding, the folding region may include a fold line printed on or formed in the document. The document can also include a printable surface, where such surface can coincide substantially with one of the security coatings. Preferably, the printed indicia is in the form of ink jet printing. The surface of the document (either on the surface of the substrate or one or both of the security coatings) can include additional security indicia, an example of which can be disposed on an opposite surface of the substrate from the first and second security coatings. This additional security indicia can be copy-evident indicia such as that taught in U.S. Patents 5,197,765 and 5,340,159, both of which are owned by the Assignee of the present invention and hereby incorporated by reference, a bar code or other related indicia. Other forms of security features that may be incorporated include laid lines, microprinting, photochromic inks, fluorescent fibers and inks, optical variable inks (OVI), secure fonts or the like. One form of the document can be a driver's permit where, in the present context, a driver's permit can cover both temporary and permanent licenses, as well as commercial and private licenses. In one preferred form, the document is a temporary driver's license. The document can also form a separable portion along at least one line of weakness, where the line of weakness preferably (but not necessarily) comprises a full die cut or a perforated die cut. In one example, the separable portion can be a driver's permit that can be removed from a larger form such that after the driver's permit is separated, the form may be discarded or (if inclusive of transactional or related data) saved as a receipt or the like. In another option, the substrate can be configured as either a cut sheet or a continuous roll or flat pack. In other options, the first and second security coatings each form a discrete layer adjacent to one another. Moreover, the abrasion-sensitive coating is pervious to solvents that would activate the solvent-sensitive coating, thus allowing the solvents to pass through to the solvent-sensitive layer disposed below.

According to another aspect of the invention, a security document includes a tear-resistant laminate substrate, a solvent-sensitive coating disposed on the substrate, an abrasion-sensitive

coating disposed on the solvent-sensitive coating, and additional security indicia disposed on at least one surface of the substrate such that attempts at tampering with the document produce notorious indicia of such tampering. The abrasion-sensitive coating is configured to receive printed indicia. One form of tampering that the security document inhibits is copying, especially photocopying. Upon such copying, a warning message (that was, for example, previously latent) is reproduced on the copied document. The substrate can include opposing top and bottom surfaces, where the solvent-sensitive coating is disposed on the top surface. In one form, the additional security indicia is placed on the bottom surface. The additional security indicia may be thermochromic ink, bar codes or pantographs, although it will be appreciated that other known security indicia may also be used. While the tear-resistant laminate may be any configuration with which to toughen the substrate, it preferably comprises a layer of film sandwiched between a pair of paper layers. In another form, the additional security indicia can be made from an additional solvent-sensitive coating. This coating is preferably disposed on the abrasion-sensitive coating, and may be the same or different than the solvent-sensitive coating disposed against the substrate.

According to still another aspect of the present invention, a driver's permit includes a tear-resistant laminate substrate, a solvent-sensitive coating disposed on the substrate, an abrasion-sensitive coating disposed on the solvent-sensitive coating, and printed indicia disposed over the abrasion-sensitive coating, the printed indicia comprising fixed text, variable text and a picture. In the present context, the requirement that the printed indicia be disposed "over" the abrasion-sensitive coating is not to be construed to limit them to being in contact with one another, but merely that the former be placed somewhere above the latter on the substrate. Thus, static printed indicia, such as press printing, may be above or below any of the tamper evident coatings. Optionally, the driver's permit further includes additional security indicia disposed on at least one surface of the substrate. This construction thwarts attempts at tampering with the document by producing notorious indicia upon such tampering. As with at least one of the previous aspects, the driver's permit is preferably a temporary driver's license. Also as previously discussed in conjunction with at least one of the prior aspects, the additional security indicia is preferably a thermochromic ink, bar code, pantograph or additional solvent-sensitive coating. In

still other options, the substrate includes a folding region, and a separable portion along at least one line of weakness, both as previously discussed.

According to yet another aspect of the present invention, a method of making a security document includes the steps of preparing a substrate to accept a plurality of security coatings, configuring a first security coating and a second security coating such that one is a solvent-sensitive coating and the other is an abrasion-sensitive coating. As with the previously discussed aspects, attempts at tampering with the document activate at least one of the security coatings to produce notorious indicia of such tampering on the document. Additional steps include depositing the first security coating on the substrate and the second security coating on the first security coating. Optionally, the step of configuring the substrate includes configuring a tear-resistant laminate similar to those previously discussed, where, by way of example, the tear-resistant laminate can be made from a layer of film sandwiched between a pair of paper layers. Another optional step can include printing indicia on the security document, where the printed indicia can be one or more of fixed text, variable text or a picture. As with the earlier-described aspects, the document can be configured as a driver's permit. Also as before, additional security indicia may be placed on the document, including (but not limited to) thermochromic ink, bar codes or pantographs. It will be appreciated that one or more of these may be combined, depending on the need. The additional security indicia can also be an additional solvent-sensitive coating configured to be disposed on the abrasion-sensitive coating. Another optional step could be configuring the additional solvent-sensitive coating to be sensitive to at least a solution containing phosphoric acid, also as previously discussed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view of a security document with two panels according to an embodiment of the present invention;

FIG. 2 is a view of a single-panel variant of the security document of FIG. 1;

FIG. 3 is a view showing the various layers making up the security document of FIG. 1;

FIG. 4 is view showing the embodiment of FIG. 3 with an additional security coating deposited thereon;

FIG. 5 shows a security document similar to that of FIG. 1 with additional detail; and

FIG. 6 shows copy-evident indicia that can be disposed on one or both sides of the security document.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. 1 and 2, a security document **1** is shown as part of a larger form **2**. Security document **1** can be an integral part of form **2** and separable therefrom along one or more lines of weakness **5**. The lines of weakness **5** can be made from a perforated die cut (as shown) or a full die cut. In other configurations, the security document **1** may be a separate card affixed to form **2**, either nested in a window of the form **2** or on top of the form **2**. The security document **1** as shown is in the form of a temporary driver's license, although it will be appreciated that the features giving the temporary driver's license its security attributes may be employed on any type of security document **1**. The temporary driver's license includes picture (or image) **10**, variable text **12** (such as individualized information, including name, signature, address, personal statistics or the like) and fixed text **14** (such as the issuing authority). While the information corresponding to the images **10** and variable and fixed text **12, 14** can be produced by any non-impact printer, including laser printers, ink jet printers, and thermal transfer printers, the preferred approach involves the use of ink jet printers. The form **2** may be a discrete cut sheet (as shown) such that it can fit into the tray of a suitable printer device, or be part of a larger continuous roll or flat pack (neither of which are shown). Form **2** can be configured such that it defines a single-panel **1A** on security document **1** (as shown with particularity in FIG. 2), or two panels **1A, 1B** as shown in FIG. 1. In this latter configuration, a folding region **20** can be formed between adjacent panels **1A, 1B** to indicate to a user where the security document **1**

should be folded. The folding region **20** may be marked (such as with a generally horizontal line across some or all of form **2**), or could be formed from a perforation or crease. A foldable version of the security document **1** is advantageous in that it allows, upon substantially coextensive folding of the two panels **1A**, **1B** over each other, a two-sided document **1** can be formed while preserving simplex (i.e., one-sided) printing. With the two-sided version, the two panels **1A**, **1B** can be folded inward to protect the images **10** and text **12**, **14** from scuffs, spills or the like. Alternately, the two-sided version may be folded outward with the two panels 1A, 1B bonded together with adhesive. In either the two-sided version of FIG. 1 or the one-sided version of FIG. 2, the size and ease of removability facilitate high rates of document production, and are amenable to other procedures, such as subsequent lamination.

Some of the security features of the present invention are made possible by the application of a plurality of coatings placed on the surface of the document **1**. These coatings (which will be described below in conjunction with FIGS. 3 and 4 below) are sensitive to various attempted forms of document tampering, providing notorious indicia **6**, **7** of such tampering. For example, notorious indicia **6** shows an area on the surface of form **2** where an attempt at alteration of the document **1** involved rubbing a solvent on the images or text. Likewise, notorious indicia **7**, shows an area abraded by an eraser or similar pressure-producing instrument such that abrasion-sensitive features in one of the coatings produce the notorious indicia **7**. It will be appreciated that the locations where notorious indicia **6**, **7** show up in FIG. 1 are for illustrative purposes only, and that the security features discussed in conjunction with the present invention could be applied to any or all parts of form **2**, specifically to the areas defined by the security document **1**. Other security-enhancing features can also be employed, such as thermochromic ink spots **150** and other security indicia **160** (such as the aforementioned bar codes, pantographs, laid lines, microprinting, photochromic inks, fluorescent fibers and inks, OVI, secure fonts or the like), both of which will be described in more detail below.

Referring next to FIGS. 3 and 4, the security document **1** construction includes numerous layers of security coatings **110, 120** and **140** deposited onto a printable surface substrate **100**. The top surface **130** of the security document **1** is ink jet printable such that digitally printed

photographs and computer-generated text may be placed thereon. The substrate **100** is preferably tear-resistant, made from (by way of example) a paper/film/paper laminate comprising layers **100A, 100B** and **100C**, respectively. An example of a suitable substrate **100** is TRU-TECH® 7.3 mil Uncoated Cover from Tru-Tech Fine Papers, Inc. of Harrison, New York. The presence of a paper-based upper layer **100A** permits easy printing from an ink jet printer, although it will be appreciated that other print-receptive upper layers (including plastic) could also be used, especially in situations where the substrate is specifically designed for ink jet printers, or if a solvent-based ink jet ink was used. Similarly, the three-layer configuration of substrate **100** depicted herein is not critical; other configurations (including other laminate configurations) could also be employed to provide enhanced tear-resistance.

The coating layers giving enhanced security include an abrasion-sensitive top coating **120** that defines the top surface **130** and provides indicia (such as by changing color, etc) when abraded by erasers, knives, fingernails or related pressure-producing instruments. Preferably, abrasion-sensitive coating **120** undergoes a color change when abraded. Although shown notionally in the figure as covering the entire upper surface of the coating immediately beneath it, it will be appreciated that abrasion-sensitive coating **120** can also be deposited in a pattern to produce a hidden message. In one preferable form, abrasion-sensitive coating **120** is self-contained such that all of the components necessary to produce the security indicia are integrated into the coating itself, rather than relying on a separate coating layer. Such self-contained coatings may include a dye precursor or chromogen (such as a leuco dye) and a color developer acting as an activating agent for the dye precursor. Either (or both) of the color former or color developer may be in capsule form. In addition, the coating may include a sensitizer to increase the sensitivity of the encapsulated agents to abrasion forces. An example of a suitable abrasion-sensitive coating may be found in U.S. Patent 5,102,856, owned by the Assignee of the present invention and hereby incorporated by reference, although it will be appreciated that others may be used. The abrasion-sensitive coating **120** is porous to solvents. Thus, if solvents are used in an attempt to defeat the security features of document **1**, the solvent will pass through the abrasion-sensitive coating **120** to activate a solvent-sensitive coating **110** disposed underneath.

Solvent-sensitive coating **110**, upon activation by a solvent, either reveals hidden words (such as "void" or the like) or causes the dispersal of a dye that provides notorious indicia that the document's visual attributes have been corrupted. In addition, solvent-sensitive coating **110** can be configured to activate upon application of an elevated temperature. By way of example, the application of a temperature in the range of 150° F or more can cause solvents and dyes in the coating **110** to interact, thereby forming a predetermined warning or related indicator. An example of a suitable solvent-sensitive coating may be found in U.S. Patent 5,209,515, owned by the Assignee of the present invention and hereby incorporated by reference, although it will be appreciated that others may be used. As with the abrasion-sensitive coating **120** discussed above, it will be appreciated that solvent-sensitive coating **110** can also be deposited in a pattern to produce hidden words or related messages.

Referring with particularity to FIG. 4, a third layer of security coating **140** can be deposited over the top surface **130** defined by the abrasion-sensitive coating **120**. Security coating **140** protects ink jet printed images from specific types of solvent attack that the solvent-sensitive coating **110** and the abrasion-sensitive coating **120** might not be sufficiently effective against. In one specific form of attack, frozen cubes of commercially-available cola beverages are rubbed over the image to alter or remove portions thereof. It has been hypothesized that the effectiveness of a cola-based attack is due to the presence of phosphoric acid in the beverage. Security coating **140** is preferably made from a tinted water-based flexographic ink. In one form, the ink comprises approximately ten to forty percent liquid dye, approximately ten to ninety percent water-soluble binder, and up to approximately one percent surface additive, the last for surface tension reduction. In this formulation, the liquid dye is a combination of three liquid dyes (such as red, yellow and blue) to produce a gray tint. With such coatings, a light tint is present in the coating. Upon attempted alteration of document **1** by the aforementioned beverage (or related solvent), a hazy-appearing halo forms.

Additional security features, such as an authentication zone in the form of thermochromic ink **150**, bar codes (not presently shown), repeating patterns (such as a "void" pantograph) or related security indicia **160** can all be optionally included to provide additional security. It will

be appreciated by those skilled in the art that the thermochromic ink **150**, and security indicia **160** could be placed on other surfaces of the security document **1**, and in some cases can be placed between the substrate **100** and the various coatings **110**, **120** and **140**, or between the coatings themselves. Thermochromic ink **150** is responsive to heat (such as due to human touch), and can change from color to colorless (or color to color) upon the application of heat, and upon removal of the heat, return to their unheated color. An example of a suitable thermochromic ink may be found in U.S. Patent 6,413,305, owned by the Assignee of the present invention and hereby incorporated by reference, although it will be appreciated that others may be used. As with the abrasion-sensitive coating **120**, the underlying message could be repeating words or the like. In one particular example, thermochromic ink **150** can be in the form of a State Seal.

Referring next to FIGS. 5 and 6, details relating to security features incorporated into security document **1** are shown embodied as a temporary driver's license. As with FIG. 1, security document **1** includes two panels **1A**, **1B** as part of form **2**, from which it can be along lines of weakness **5**. Picture **10** and variable text **12** convey information specific to the driver. Fixed text **14** may convey information related to the issuing authority. Folding region **20** permits the document **1** to be simplex printed and folded over to form a multilayer license. By being included as part of form **2**, a blank of the security document **1** may be placed in a cut sheet tray of a simplex printing device (not shown), such that upon entry of appropriate driver and related information into automated data processing equipment (not shown), the license can be printed, separated and folded in a very short time period while retaining all of the security features built in to the document **1**. Referring with particularity to FIG. 6, the bottom surface of form **2** is shown, where security indicia **160** in the form of a "void" pantograph is shown to demonstrate that such indicia may be in the form of a patterned coating, ink or the like. In the "void" pantograph form shown, the entire bottom surface of form **2** (of which security document **1** defines a part) appears, giving someone viewing form **2** a readily apparent indication that the document being viewed is a photocopy. It will be appreciated that the "void" pantograph is shown as a representative rather than exclusive use of additional security indicia **160**, and further that such techniques can be used on either surface of substrate **100**, as well as (in some instances) between substrate **100** and one or more of the layers of security coatings **110**, **120** and **140**.

Having described the invention in detail and by reference to preferred embodiments thereof, it will be apparent that modifications and variations are possible without departing from the scope of the invention defined in the appended claims.

We claim: